CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/343
24 August 1971
Original: English

JAPAN

Working paper on a biological approach to the question of verification on the prohibition of chemical weapons

- Organophosphorus chemical agents -

As the SIPRI Report "The Problem of Chemical and Biological Warfare, Part IV Verification (February 1970)" has described, nerve agent plants are usually kept air tight and operated at a negative pressure. Furthermore, critical chemical reaction equipment is handled by remote control devices, and so forth, then plants are designed to avoid exposure of the chemical agent to workers. Thus, the safety facilities are presumably completely organized. It is no doubt that continuous and periodical health examinations are executed for the ideal labour management.

Here, we should like to make an attempt on a biological approach to the question of verification on the prohibition of chemical weapons from the viewpoint of workers' health control.

The biological effects of organophosphorus compounds depend mainly on their inhibitory effect on the activity of cholinesterase in man, and the inhibition rate is said to run parallel to the dose. It is also known that a change in the activity of cholinesterase in the body takes place by the presence of an organophosphorus compound in a quantity which is too small to produce any clinical symptom, either subjective or objective, in man. Consequently, the measurement of the change is regarded as a useful indicator for checking whether or not the body has been exposed to an organophosphorus compound.

It is to be noted further that the measurement of the activity of cholinesterase in the blood requires relatively simple techniques, since the cholinesterase in the plasma, which is the amorphous part of blood, is more easily affected than that in the other organs or tissues; and moreover the activity level of the cholinesterase in the red cells, which are the solid part of the blood, undergoes an irreversible change. Therefore, the measurement of the change in the activity of the cholinesterase in both plasma and red cells could be used as an effective and practicable method in protecting those who are engaged in activities which have a possibility of exposure to chemical compounds of the organophosphorus family.

GE.71-19161
71-19656

It might be worthwhile mentioning in this context the governmental guideline adopted in Japan for the purpose of maintaining the health of workers in factories producing or using organophosphorus compounds. Under this policy, the diagnosis of such symptoms as a decline in the level of activity of the cholinesterase in the blood, sudoresis or excessive perspiration, miosis or the contraction of the pupil and muscular fibrillation of the eyelids and the face are suggested as criteria for the periodical medical examinations. As mentioned above, among the four criteria of the examinations, a decline in the level of activity of the cholinesterase is the most sensitive. Therefore it becomes the best parameter for the biological change by the effect of organophosphorus compounds. Based on the above guidance, in a case where the activity level of the cholinesterase in the plasma of a worker is found to have dropped by thirty percent or more, he should be transferred to another post or given a certain period of rest for the purpose of natural physical recovery.

According to the above guidance, organophosphorus compound producing plants in our country have made great efforts for the maintenance of workers' health. For example, in the case of workers in organophosphorus pesticide producing plants, the level of activity of the cholinesterase in workers' plasma is measured three or five times before workers start to work in the plant, and therefore, the mean value of the level calculated as before-mentioned is recorded as the individual normal level of activity. The workers' level of activity of the cholinesterase is examined regularly, which varies from every two weeks to two months according to the toxicity of the pesticide which is being produced. We have not had any significant incidents for over ten years up to the present, including the period of producing even parathion which has a high toxicity on mammals. In a general observation, however, under similar conditions of labour management, the decline in the level of activity of the cholinesterase among workers who are engaged in the production of organophosphorus compounds compared with that among workers who are engaged in the production of other chemical compounds is remarkable.

Of course, even when a change is detected in the level of activity of the cholinesterase in the blood, it would be almost impossible to draw from that fact an inference as to the type or the amount of production of the chemical compound. On the other hand, considering the fact that some of the organophosphorus compounds now used for peaceful purposes could be employed as chemical weapons and the plants now producing such compounds could change the nature of production as the need arises, a means of verification which covers a wide range of organophosphorus compounds might be useful.

It should be natural that the facilities of a factory vary according to the degree of the workers' exposure to organophosphorus compounds. However, even in the case of a plant with ideal equipment where the possibility of exposure to organophosphorous organophosphorus compounds might be completely eliminated, it would still be necessary from the medical point of view, as long as there are workers engaged in the production, to conduct a medical examination to completely ensure the safety. In the case of a factory where precaution measures are being taken to such an extent as would completely eliminate the possibility of exposure, no biological change is detected in man. Such special precaution measures themselves would provide useful data for verification purposes.

In accordance with the above considerations, we should like to suggest that this Committee explore the possibility of establishing a method of verification based on the examination of the level of activity of the cholinesterase in the blood of people working in chemical plants engaged in the production of organophosphorus compounds and whether extraordinary safety measures are being taken in such plants.